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(54) A bed for a disabled patient

(57) A bed to enable disabled patients to be turned over when they are unable to move themselves has a mattress 10 located on a fixed framework. Across the top of the mattress, and in a loop below it, there is a belt 16 which runs around rollers 12, 13 and which is taken up and dispensed in turn from contra rotating rollers 30, 31. Idler rollers 22 positioned outwardly of the rollers 12 have a continuous loop sheet 20 positioned therearound. All of the rollers are connected to hydraulically operated pistons 5 by a movable framework so that when the pistons 5 are raised all of the rollers are raised so that a patient cradled within the sheet 20 is raised by the belt 16 and suspended above the mattress. The belt is then driven

around rollers 30, 31 so that the patient is rolled over by the belt. Upon a predetermined position of the belt being reached, or alternatively upon a stop command being given, the rollers are lowered so that the patient is returned onto the mattress. The rollers 30, 31 act as counterweights and return the pistons to their lowermost position.

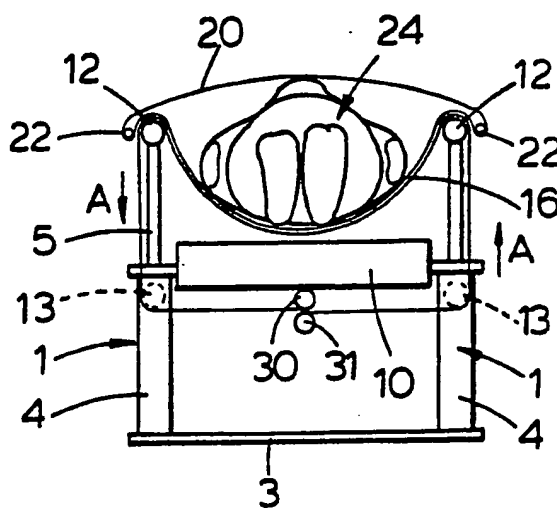


Fig.2

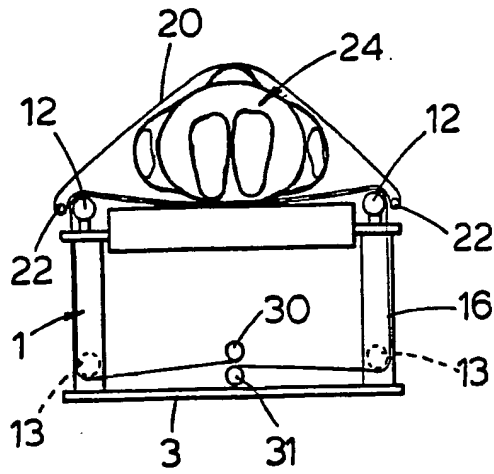


Fig. 1

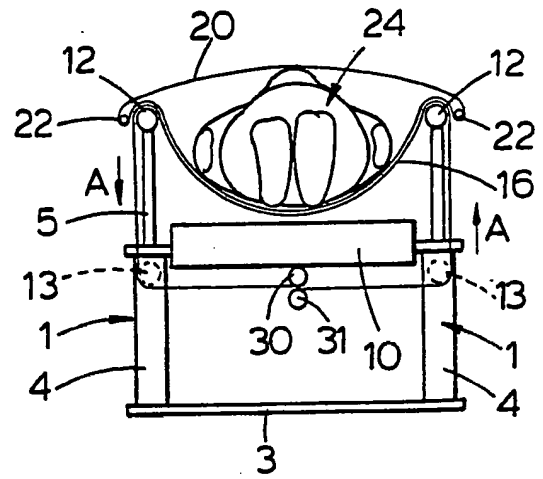


Fig. 2

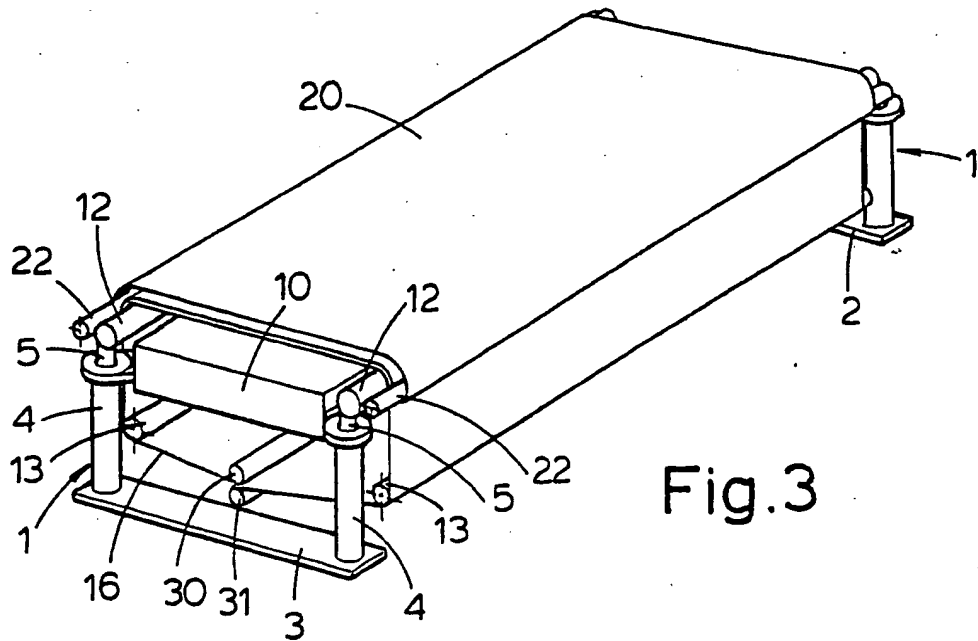


Fig. 3

SPECIFICATION

A bed for a disabled patient

- 5 This invention relates to a bed for a disabled patient which enables the patient to be easily turned over in the bed.

Paraplegics and those who are paralysed in other ways are often completely unable to
 10 move their own bodies yet have to be moved by rotation on a regular basis to keep them reasonably comfortable and to prevent secondary infections occurring. Although hospitals may have sufficient staff to turn patients, with
 15 reductions in nursing staff, patients may not be turned as often as necessary. Moreover it is very often difficult for patients at home to be moved as they need since it normally requires two people to turn a patient. Because
 20 of this problem, patients who could otherwise be cared for in their homes have had to be retained in hospitals, placing further demands on hospital staff.

According to the present invention there is
 25 provided a bed having drive means for driving four spaced vertical rams each ram having a respective reciprocal piston liftable by the drive means, and a fixed frame for locating a mattress between the rams, the rams being
 30 connected to a movable framework comprising a first pair of spaced longitudinal rollers each arranged to lie along a respective longitudinal side of the mattress, a second pair of spaced longitudinal rollers located below said
 35 first pair of rollers, and positioned between the rollers of said second pair of rollers, a pair of longitudinal drive rollers arranged to be driven by said drive means, a belt connected from one said drive roller around the first and
 40 second pairs of rollers and, in use of the mattress top, a third pair of rollers positioned outwardly of a respective roller of said first pair of rollers, and a continuous sheet looped around said third pair of rollers to overlie the
 45 belt, whereby in operation actuation of said drive means causes the movable framework to be raised by the piston rams to lift a patient off the mattress so as to be cradled in the continuous sheet on the belt and upon a
 50 predetermined height being reached so said drive means drives the drive rollers so that the belt is taken from one drive roller and taken upon by the other drive roller to thereby rotate the patient.

55 The sheets and blankets which make up the bedding are arranged above the belt, where the belt overlies the mattress. When the movable framework is raised, the patient is lifted clear of the mattress and is suspended on the
 60 belt, still in the bedding, above the mattress. When the belt is now driven around the movable framework, the patient is rolled over and once this has been done, the framework is automatically lowered so that the patient
 65 once again rests on the mattress, but now in a

different position.

The drive means is preferably a hydraulic pump actuated by an electric motor and the electric motor is advantageously activated by
 70 a pressure switch although if so desired the electric motor may either/or be actuated by a time switch.

Conveniently a single control, such as a rubber pressure producing bulb, with a single
 75 operating movement is provided to control all stages of operation. Preferably a switch-over mechanism is provided so that when the belt has reached the limit of its movement in one direction, the driving means will reverse and
 80 cause the belt to start to move in the opposite direction. Advantageously an override switch is provided to stop or reverse the direction of the belt drive.

The drive rollers are conveniently interconnected by a gear wheel so that the rollers are
 85 rotatable in counter directions and said gear wheel is driven by a rack means which in turn is driven by the drive means. Advantageously the drive rollers each have a longitudinal slot
 90 therein and each is arranged to receive one end of the belt. Advantageously the drive rollers act as counterweights to return the bed to an initial, rest, position.

Preferably a rack is vertically positioned
 95 alongside each ram and a respective pinion provided to move along each rack, said pinions being serially interconnected to provide stability for the ram pistons.

Conveniently the continuous sheet has a
 100 longitudinal fastening the whole length thereof to facilitate removal of the sheet and to permit a patient to be positioned between the upper and lower runs of the sheet. Advantageously castors are mounted on hydraulically operated jacking rams so that the bed
 105 may be moved on said castors.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:—

110 *Figure 1* is a schematic end view of a bed according to the invention, illustrating the bed in a lowered position.

Figure 2 is a schematic end view of the bed shown in *Fig. 1* in a raised position, and

115 *Figure 3* is a perspective view of the bed in accordance with the invention in a lowered position.

In the Figures like reference numerals denote like parts.

120 The bed shown in the Figures has a fixed framework formed by four spaced vertical hydraulic rams 1 effectively forming the legs of the bed and with the pair of rams 1 at the head of the bed connected by a plinth 2 and
 125 the rams at the bottom end of the bed connected by a plinth 3. The rams 1 are formed by an outer cylinder 4 and an inner, vertically movable piston 5.

Mounted to be stationary with the cylinder 130 4 is a mattress 10 upon which a patient 24

(shown schematically in Figs. 1 and 2) will lie. The framework supporting the mattress has been omitted for clarity.

A movable framework is formed by two parallel, spaced longitudinal top rollers 12 and two parallel, spaced longitudinal lower rollers 13, one roller 12, 13 being at one longitudinal side of the bed with the other roller 12, 13 being at the other longitudinal side of the bed. The rollers 12, 13 are mechanically fixedly linked together and connected to a piston 5 by means not shown. The journals at each end of the rollers 12, 13 are not shown for clarity. Also mechanically connected to the piston 5 and lying at the outer side of each roller 12 is an idler roller 22 which is parallel therewith. Longitudinally located beneath the mattress 10 is a pair of parallel, spaced contra-rotating rollers 30, 31 which are interconnected by a gear wheel (not shown) to provide the contra-rotation thereof and linked to be moved with the piston 5. It is to be noted that the rollers 30, 31 are used as counterweights to reset the height of the mattress as will be described hereinafter. The gear wheel is in turn driven by a rack (not shown) and the rack is arranged to be hydraulically driven. Each roller 30, 31 has a longitudinal slot therein for insertion of a respective end of a belt 16 and the belt extends from roller 30 about the left hand (as viewed in the Figures) roller 13 between rollers 22 and 12, over roller 12, the mattress, thence over the right hand roller 12, between the right hand roller 12 and roller 22, thence about the right hand roller 13 to be taken up by roller 31. The rollers 30, 31 have a tensioning device so as to adjust the tension of the belt 16 and the belt is held on the rollers 16 by being inserted into the longitudinal slot thereof and the roller being rotated through at least one turn so that the belt then holds itself in position due to the overlap thereof.

A sheet 20 in the form of a continuous loop extends around idler rollers 22 and over the top of the belt 16. To permit changing of the sheet 20 and to allow a patient to lie between the upper and lower runs of the sheet 20, a longitudinal fastening, such as a zip (not shown), is provided in the top run of the sheet.

So as to provide stability for the pistons 5 there is provided, at the internal sides of the rams 1, a vertical rack, and a respective pinion is provided to run along each rack, with each of the pinions being serially interconnected to form a closed loop by stabilising shafts, none of these integers being shown for clarity.

A hydraulic rotovane pump (not shown) having a pressure of approximately 100 lb/in² (7030.7g/cm²) is provided to drive the rams and to operate the rack turning the contra rotating rollers 30, 31. The hydraulic pump may be operated by the patient squeez-

ing a rubber bulb (pressure switch) such that when the rubber bulb is squeezed a small piston actuates a tilt mercury switch controlling the power supply to an electric motor to thereby drive the hydraulic pump.

In operation, with a patient 24 lying between the upper and lower runs of the sheet the bed starts from the initial position shown in Figs. 1 and 3. The patient if possible should raise their legs as shown in Figs. 1 and 2 so that the sheet 20 is drawn tightly and the patient exerts a high friction with both upper and lower runs of the sheet 20. Upon the rubber bulb (not shown) being squeezed so the tilt mercury switch turns on the electric motor and the hydraulic pump forces fluid through valve ports to simultaneously raise all of the pistons 5. Because the rollers 12, 13, 30, 31 are mechanically linked to the pistons 5 so the complete movable framework is raised. The patient is thus raised from the mattress 10 to be supported solely by belt 16 and the patient is thus cradled as shown in Fig. 2. When the pistons 5 reach the top of their allowable movement so fluid passes through outlet ports to drive the rack and gear to drive the contra rotating rollers 30, 31. Assuming roller 30 is driven in an anti-clockwise direction and roller 31 is driven in a clockwise direction then the belt 16 will be driven as shown in the direction of the arrow-headed lines A of Fig. 2 and the patient will be rolled in a clockwise direction. Upon a predetermined travel of the rack, and hence rollers 30, 31 and belt 16, so the pump is switched off and a hydraulic valve is operated to exhaust the fluid to permit lowering the pistons 5. Upon the patient being lowered back onto the mattress 10, the weight of the rollers 30, 31 are used as counterweights to lower the pistons 5 to their lowermost position where the rollers 12 and 22 are substantially level with the top of the mattress 10. Such an arrangement is beneficial to a patient since the patient is not faced with a barrier wall. It will be realised that the final lowering of the pistons 5 cannot be achieved by the weight of the patient since the patient is supported by the mattress 10 and so the rollers 30, 31 by acting as counterweights for the movable framework perform an important role.

The sheet 20 by being provided in a continuous loop ensures that a patient is kept in the bed without the need of rails and helps rotation of the patient by virtue of the increased friction when a patient's knees are raised to thereby facilitate ready turning of the patient.

The next time that the bed is raised to turn the patient so the rollers 30, 31 will be driven in the opposing direction to that above described so that the belt 16 will be driven in the reverse direction of the arrow headed lines A so that the patient is turned onto his other side. By such rotation a patient may be moved through at least 180°. It is desirable

that it is un-necessary for the rack to have to reach its extreme ends of motion every time a patient is returned and the rack may be stopped from driving the rollers 30, 31 by the patient at any convenient stage. It is also desirable that instead of using a rubber bulb to raise and turn a patient the electric motor driving the hydraulic pump may be connected to a time switch so that the patient is automatically turned at regular intervals. Moreover it is desirable that a push-pull override button is provided to change or stop the direction of rotation of the belt 16.

If it is desired the bed may be provided with castors which may be hydraulically jacked downwardly to raise the bed for movement.

It will be appreciated that by providing the bed with hydraulic rams safety is increased since there is no necessity for electric current to be in the vicinity of the bed. Moreover once the bed has been raised and the patient turned then the bed automatically returns to its initial condition.

CLAIMS

1. A bed having drive means for driving four spaced vertical rams each ram having a respective reciprocal piston liftable by the drive means, and a fixed frame for locating a mattress between the rams, the rams being connected to a movable framework comprising a first pair of spaced longitudinal rollers each arranged to lie along a respective longitudinal side of the mattress, a second pair of spaced longitudinal rollers located below said first pair of rollers, and positioned between the rollers of said second pair of rollers, a pair of longitudinal drive rollers arranged to be driven by said drive means, a belt connected from one said drive roller around the first and second pairs of rollers and, in use of the mattress top, a third pair of rollers positioned outwardly of a respective roller of said first pair of rollers, and a continuous sheet looped around said third pair of rollers to overly the belt, whereby in operation actuation of said drive means causes the movable framework to be raised by the piston rams to lift a patient off the mattress so as to be cradled in the continuous sheet on the belt and upon a pre-determined height being reached so said drive means drives the drive rollers so that the belt is taken from one drive roller and taken upon by the other drive roller to thereby rotate the patient.

2. A bed as claimed in Claim 1 wherein the drive means is a hydraulic pump actuated by an electric motor.

3. A bed as claimed in Claim 2 wherein the electric motor is actuated by a pressure switch.

4. A bed as claimed in Claim 2 or Claim 3 wherein the electric motor is activated by a time switch.

5. A bed as claimed in any preceding Claim wherein a single control with a single operating movement is provided to control all stages of operation.

6. A bed as claimed in any preceding Claim wherein a switchover mechanism is provided so that when the belt has reached the limit of its movement in one direction the driving means will reverse and cause the belt to move in the opposite direction.

7. A bed as claimed in Claim 6 wherein an override switch is provided to stop or reverse the direction of belt drive.

8. A bed as claimed in any preceding Claim wherein the drive rollers are interconnected by a gear wheel so that the drive rollers are rotatable in counter directions and said gear wheel is driven by a rack means which in turn is driven by the drive means.

9. A bed as claimed in any preceding Claim wherein the belt rollers each have a longitudinal slot therein, and each is arranged to receive one end of the belt.

10. A bed as claimed in any preceding Claim wherein the drive rollers act as counterweights to return the bed to an initial, rest, position.

11. A bed as claimed in any preceding Claim wherein a rack is vertically positioned alongside each ram and a respective pinion is provided to move along each rack, said pinions being serially interconnected to provide stability of the ram pistons.

12. A bed as claimed in any preceding Claim wherein the continuous sheet has a longitudinal fastening the length thereof.

13. A bed as claimed in Claim 2 wherein castors mounted on hydraulically operated jacking means are provided whereby the bed may be moved on said castors.

14. A bed substantially as herein described with reference to, and as illustrated in, the accompanying drawings.

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